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Decontamination, Disposal, & Documentation



INTRODUCTION

This module discusses ways in which equipment and personnel can become contaminated with radioactive material and describes some field decontamination methods. Some of the PPE and equipment used in decontamination needs to be disposed of properly to prevent further spread of radioactive contamination. Once contaminated material is bagged, it needs to be labeled, documented, and disposed of properly.

PURPOSE

The purpose of this module is to inform you of methods used to decontaminate personnel and equipment. This information will help you prevent further spread of radiological contamination and minimize the amount of radioactive waste generated when performing response activities at the scene of a transportation incident involving radioactive material.

MODULE OBJECTIVES

Upon completion of this module, you will be able to:

1. Identify how personnel, personal protective equipment, apparatus, and tools become contaminated with radioactive material.
2. State the purpose of radioactive decontamination.
3. Identify field decontamination techniques for equipment.
4. Identify field decontamination techniques for personnel.
5. Identify your responsibilities for radioactive material disposal and event documentation.

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RADIOACTIVE CONTAMINATION

Radioactive contamination is undesired radioactive material deposited on the surfaces of or inside structures, areas, objects, or people. Radioactive material can be solid, liquid or gaseous. If radioactive material is released from a package, personnel, personal protective equipment (PPE), apparatus, and tools can become contaminated if they contact this material. When individuals (accident victims or response personnel), PPE, or equipment become contaminated, the contamination can easily be spread by cross-contamination or secondary contamination to other persons, equipment, or surfaces. Care should be taken to avoid cross contamination. The following practices will help to avoid spreading contamination:

- Change gloves after handling accident victims and contaminated equipment
- Avoid unnecessary activity in the contaminated area
- Sleeve or wrap equipment prior to entry into the area
- Adhere to the policy of no eating, drinking, smoking, or chewing in the hot zone
- Avoid touching unprotected skin areas

Performing a thorough contamination survey on individuals and equipment exiting the hot zone area can also help minimize the spread of contamination.

Personnel can become contaminated internally, externally, or both. Internal contamination occurs when radioactive material is ingested or inhaled or otherwise taken into the body. External contamination occurs when radioactive material gets on you or your clothing.



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RADIOACTIVE DECONTAMINATION

Radioactive decontamination involves removing radioactive material (contamination) from locations where it is not wanted. Decontamination is performed in order to:

- Decrease radiation exposure by removing the radioactive material
- Prevent further spread of radioactive material
- Prevent or decrease the risk of internal contamination

FIELD DECONTAMINATION

Field decontamination means setting up a decontamination station near the incident scene and performing decontamination of personnel and equipment. If equipment is not to be decontaminated in the field, it will need to be bagged, labeled as “radioactive,” and properly shipped to a facility where decontamination can be performed. When field decontamination procedures are being considered, evaluate the advantages and limitations of field decontamination.

Advantages

One of the main advantages of field decontamination is that it removes the source of contamination and limits the potential spread of contamination. Decontaminating equipment can free up potentially contaminated resources needed outside the hot zone.

Limitations

Field decontamination is time consuming. Untrained personnel can further slow up the process. Even when personnel have been decontaminated, they cannot be considered “clean” until surveyed by a properly trained radiation authority.

A lack of properly trained personnel is the limiting factor. Personnel often lack training not only in radiological instrument use but also in proper methods of field decontamination.

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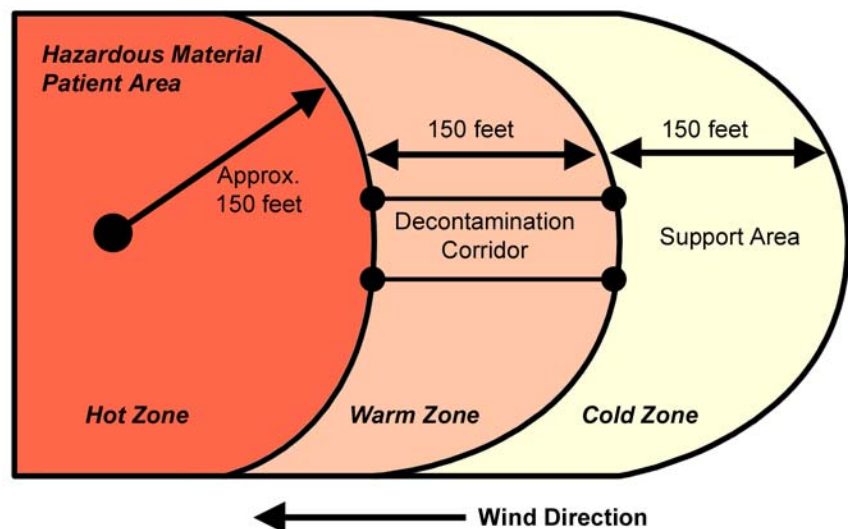
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Another limitation of field decontamination is that using wet methods may produce large quantities of water or liquid that will need to be contained, surveyed, and properly disposed of if found to be contaminated.

FIELD DECONTAMINATION SET-UP

If field decontamination is necessary, it is important to establish a decontamination station/area. As with other hazardous material incidents, the decontamination corridor is usually established inside the warm zone running between the hot zone and cold zone. The Incident Commander and Safety Officer will determine where the decontamination corridor should be established and will consider the following:

- Wind direction relative to incident scene
- Background radiation levels
- Hot, warm, and cold zone boundaries
- Areas for best access into and out of incident scene



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The decontamination corridor will need the following:

- **Equipment drop area** (inside hot zone) - This is where tools, equipment, etc., should be set down to wait for radiological survey. A small piece of plastic or poly can be placed on the ground to define the drop area. The plastic or poly will also serve to protect the ground from secondary contamination from equipment.
- **Clothing removal station** - This is where protective clothing will be removed and placed into appropriate containers (provide plastic lined containers).
- **Radiological survey station** - This is the area where, after removing protective clothing, personnel are surveyed for radiological contamination. Radiological surveys need to be performed by qualified individuals. Personnel who are contaminated must go to the decontamination station. Personnel who survey "clean" will be allowed to exit into the cold zone.

If you suspect that personnel exiting the hot zone may not be contaminated, you may want to consider surveying them prior to removal of their protective clothing. If personnel survey clean while wearing their protective clothing, the clothing will not need to be disposed of as radioactive waste. Personnel should be surveyed again after removal of their protective clothing.
- **Decontamination station** - This is where personnel decontamination is performed. After decontamination, personnel will return to the radiological survey station for a second survey to determine the effectiveness of the decontamination effort.

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EQUIPMENT DECONTAMINATION

Equipment decontamination involves removing radiological contamination from equipment. Not all equipment can be decontaminated (e.g., straps, porous material, equipment with inaccessible areas). Some preplanning before taking material into the hot zone can help prevent equipment from becoming contaminated. For example, equipment can be placed in a clear poly bag before being taken into the contaminated area. Upon exit from the area, the contaminated bag can be removed and disposed of. Radiological Control personnel routinely bag radiological survey instruments prior to entering a contaminated area to prevent instruments from being contaminated.



If equipment needs to be decontaminated, consider the following methods:

- **Critical hand-held equipment** - Trained personnel can attempt to decontaminate equipment by wiping it down with a damp, absorbent cloth
- **Clothing or other items** - If the contamination is loose and/or dry, equipment can often be decontaminated by using a tape press. This is similar to removing lint from a piece of clothing
- **Critical heavy equipment** - Trained personnel can attempt decontamination using a non-abrasive wash solution

All solid and liquid waste generated during decontamination will need to be controlled, properly packaged, and stored for eventual disposal in accordance with local procedures.

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PERSONNEL DECONTAMINATION

Use of traditional hazardous material decon procedures may not be necessary if radioactive material is the only hazard present. While use of traditional hazardous material decon processes are effective for radioactive material, their use may generate large quantities of wastewater. Consideration should be given to methods that will minimize the amount of waste generated. There are simpler methods available for decon that are less time consuming, require fewer resources and generate less waste. A model procedure showing methods for personnel decontamination is located in the appendix to this module.

Removing all clothing (gross decon) can dramatically reduce the contaminants on a person's body. After performing a gross decon, clothing should be left inside the hot zone. This clothing should be contained and controlled until surveyed. Minimizing the accumulation of contaminated or radioactive material (removed clothing, packages, etc.) in the area will help keep area radiation dose rates low.

Personnel decontamination may be accomplished by using conventional cleansing techniques on localized contaminated body surfaces (i.e., gentle washing and flushing that does not abrade the skin surface). When washing and flushing skin surfaces, mild soap and lukewarm water are preferred. Lukewarm water is preferred because cold water can cause skin pores to close, fixing the contamination into the skin. Hot water can cause skin pores to open, allowing the contamination to go deeper into the skin. Any water or material used in this process needs to be contained and considered radioactive waste. Techniques beyond gross decon should only be performed by properly trained personnel.

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STOPPING FURTHER RELEASE OF RADIOACTIVE MATERIAL

Minimizing the spread of radioactive material may become important during the emergency phase of an incident. This is usually the responsibility of the hazardous material response team. If you are not trained in methods for controlling the spread of radioactive material, DO NOT attempt them. Let properly trained personnel take this responsibility. Some things you can do are:

- Dike or contain any runoff water that may be contaminated
- Ensure that equipment inside the hot zone stays there until surveyed for contamination
- Ensure that all fires are out as soon as possible to limit the spread of radioactive material via smoke

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WASTE DISPOSAL

Waste disposal can be a problem at any hazardous material scene. For a radiological incident, processes should be put in place as soon as possible to ensure all radioactive waste is contained.

1. Have plastic-lined waste containers at the entry/exit of the decontamination corridor for disposing of potentially contaminated material. These containers are often the same as for other hazardous material contaminated wastes.
2. Seal the tops of full plastic bags and place them in a holding area inside the hot zone. Ensure that containers are marked as “radioactive” and are properly stored for disposal later.
3. Ensure that the area is monitored periodically because, as waste material accumulates, increased radiation dose rates are possible.
4. Let properly trained personnel (state response team, hazardous material response team, and contractors) survey waste material for contamination. Contaminated waste will need to be disposed of in accordance with applicable regulations.
5. Survey all personnel and equipment prior to their exit from the hot zone. Items found to be contaminated should be decontaminated or properly packaged for future decontamination or disposal.



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Other Considerations

Prior to making decisions about disposing of any material as waste, or taking the time to decontaminate material and equipment, consider the following:

- Many radioactive materials have very short half-lives. Commonly shipped medical and research isotopes have half-lives of hours or days. Short-lived material can be sealed in a package to await decay of the material to a stable or non-radioactive state.
- When using large quantities of water for decontamination, remember that the water has to be handled as radioactive material. Contaminated water can be difficult to deal with and expensive to process.
- Do not generate unnecessary waste. Use only the material needed to complete a safe and effective response.

DISPOSAL AND DOCUMENTATION RESPONSIBILITIES

Once the initial response phase of the incident is over, the focus will switch to cleanup and disposal of radioactive waste. The carrier is responsible for costs associated with scene cleanup and the disposal of radioactive material/waste. Carriers of radioactive material are required to provide financial protection to the public in the unlikely event of an incident involving radioactive material. The required amount of liability coverage for carriers of radioactive material varies according to the mode of transport (road, rail, waterway, or air) and the type and quantity of radioactive material being shipped. If the damages from a transportation-related accident exceed the amount of the carrier's private insurance coverage, umbrella coverage is provided under the Price-Anderson Act.

Event documentation and reporting is an important step in recovering costs associated with a transportation incident involving hazardous material. Time, resources, and property damage must be recorded for payment. Documentation will be the legal evidence necessary in the future. Your documentation must include, who, what, when, where, how, and why.

Check Your Understanding



1. Radioactive contamination can take the form of a _____, _____, or _____.
2. List two reasons for performing radiological decontamination.

3. Personnel _____ is usually accomplished using mild soap and lukewarm water.
4. Which of the following statements is true regarding equipment decontamination?
 - a) Contaminated equipment should be hosed off immediately
 - b) Contaminated equipment should not be taken into the hot zone
 - c) Equipment that is contaminated should be disposed of as radioactive waste
 - d) Not all equipment can be decontaminated
5. For decontamination operations, a _____ is usually established inside the warm zone, running between the hot zone and cold zone.
6. The _____ is responsible for costs associated with scene cleanup and the disposal of radioactive material/waste.
7. Event _____ and reporting is an important step in recovering costs associated with a transportation incident involving hazardous material.

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ANSWERS

1. solid
- liquid
- gas
2. See page 3
3. decontamination
4. d
5. decontamination
6. coordinator
7. documentation